

THE CONTROL OF DENDROCTONUS MONTICOLA AND DENDROCTONUS
BREVICOMIS ON THE OCHOCO NATIONAL FOREST

A.H. HODGSON
1913

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FOREST INSECT LABORATORY,
STANFORD UNIVERSITY CALIFORNIA

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Insects.

THE CONTROL OF DENDROCTONUS MONTICOLA AND D. BREVICOMIS
on the
OCHOCO NATIONAL FOREST
1913.

Section I. THE ADMINISTRATION OF THE OPERATION.

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Insect Control Camp 1913,
In Badger Creek Watershed
Lodgepole and Yellow Pine in Background,
Through which Bark Beetles have Worked.

The Administration of Insect Control Operations

on the

Ochoco National Forest

1913.

A. INTRODUCTION.

I. Object of the Work.

In the early spring of 1913, an appropriation of \$6500.00 was given the Ochoco National Forest for the purpose of controlling the infestations of *Dendroctonus monticola*, (Mountain pine bark beetle) and *Dendroctonus brevicornis* (Western pine bark beetle) that threatened valuable stands of *Pinus contorta* (Lodgepole Pine) and *Pinus ponderosa* (Western Yellow Pine) timber within its boundaries.

The main object of the operation was to show whether or not the extensive infestations of these two insects could be controlled through artificial means, the results obtained here to determine the advisability of making further efforts to control similar infestations on other Forests, as well as to decide upon the best method for control work.

II. Location of the Work.

The Ochoco Forest includes portions of Crook, Wheeler, Harney and Grant Counties in Central Oregon, and takes in most of the timber standing upon an independent spur of the Blue Mountains. This body of timber is entirely isolated from other stands of timber, except on the east side, where it is joined by the Malheur Forest. This isolation makes it an ideal forest to carry on such an experiment as is dealt with in this report.

The work of this year was carried on in the Badger Creek watershed, tributary to the John Day River, and in the Happy Camp Creek and Jackson Creek watersheds, tributary to Crooked River. (See map accompanying report on "The Technical Phase of Insect Control Operations" by J. F. Pernot).

III. Part Insect Control Operations and Scope of Present Work.

During the winter of 1910, four rangers were sent to the Badger Creek watershed for the purpose of controlling a small infestation of *Dendroctonus monticola* (working in Lodgepole pine.) Climatic conditions and a greater infestation than was anticipated prevented any tangible result.

Nothing more was done towards controlling the infestation on the Ochoce Forest until the spring of 1912, when an appropriation of \$2800 was made. This amount was spent in treating 3,400 infested trees in the upper portion of the Badger Creek watershed. (See Deputy Supervisor Barnes' reports of November 13, 1911 and July 6, 1912). A thorough inspection this spring of the above area treated, showed splendid results.

The operation of 1913 was started on the 18th of April at the beginning of the infestation, at the lower end of the Badger Creek watershed, and carried up stream until it overlapped the work of 1912. When this point was reached, the entire Badger Creek area had been covered, with practically no infested trees left upon it. The operation was then transferred to the Happy Camp Creek and Jackson Creek watersheds.

B. THE SYSTEM USED IN CONTROL WORK.

I. Marking.

The marking of infested timber for cutting was found to be one of the most important features of the operation. This project was fortunate in having Mr. J. F. Pernot, who has specialized on insect control work, to take charge of this branch of the enterprise, and who will deal more fully with "the factors governing the marking of infested timber" in his report on "The Technical Phase of Insect Control Operations." Since a specialist is not always available, however, a few points regarding marking from the administrative standpoint might be mentioned here for the benefit of future operations.

It was found that no man should be allowed to mark until his eye was thoroughly trained to detect infested trees and determine whether or not a given tree should be cut. This training can be gained only through actual field work, where close observations of many felled trees can be made. A trained marker is essential to a control operation because it is costly work to cut down and treat trees that are not infested, or in which there are no living beetles or larva. It is equally costly to pass by trees infested, for if left, they represent points for fresh infestations in the future.

For an operation as large as the one under discussion, it takes three men to cruise, survey lines, and do the marking in order to keep ahead of the treating crews. It was found that the marking should be carried on in a thoroughly systematic

PLATE I.

Lodgepole Pine Infested with *D. Monticola*
Marked for Cutting.

Small Yellow Pine Infested with *D. Monticola*
in the Left Foreground.

(Taken from same position as Plates III & V.)

manner. The infested block was divided into small units, the unit being an area large enough to keep one treating crew busy for several days. The markers crossed and recrossed the unit by narrow strips and were urged not to hurry with the work, but to scan every tree carefully before marking or passing it by.

When *D. monticola* and *D. brevicornis* are common in the same infestation, two distinct marks should be used so that the trees infested by each beetle can be recognized by the treating crews, since the treatment for the two species of insects is quite different.

Owing to the administrative work attached to a large operation, one man thoroughly qualified should be placed in charge of the marking work. This gives the administrative officer more time to supervise the work of the crews and to keep a closer watch over the project as a whole.

II. The Organization of Treating Crews.

The size of the treating crew was found to be an important matter. The number of men to a crew depends upon several factors, chief among which are:

1. The size of the operation.
2. The dimensions and position of the timber.
3. The character of the laborers at hand.
4. The amount of supervision available.

If the operation is not large, the timber is small or scattered, the laborers are reliable and there is sufficient supervision, small crews of from 4 to 6 men are the best to use, but when the reverse conditions prevail, crews of from 6 to 8 men were found to obtain the best results. (Crews should not contain

less than four men, nor more than eight.)

On this project, 6 or 8 man crews proved to be the best. Better results were also obtained when one man in the crew acted as sub-foreman, or "straw-boss" at a slight increase in pay.

For the treatment of Lodgepole and small Yellow Pines, the crews were divided as follows:

6-man crew
2 fallers
1 buckler
1 limber
2 log and brush pilers.

The pilers, however, were unable always to keep up with the other branches of the work, and so the 8-man crew was found to be the better balanced, and was divided as follows:

8-man crew
2 fallers
1 buckler
1 limber
4 log and brush pilers.

In this case, the pilers often assisted the limber, and in piling large logs the limber assisted the pilers.

III. Felling.

For each crew, two of the best sawyers were chosen to fell the timber. The way in which the trees were felled influenced the work of the other men in the crew. For this reason, an effort was made to take advantage of natural openings to drop the trees into, and instead of jackstrawing the trees into piles they were dropped parallel with each other so that the limbers and bucklers could work to a better advantage. When windrowing was resorted to, however, the trees were dropped into parallel windrows whenever possible. Stumps were cut 18 inches or lower, and whenever

they were badly infested, they were peeled. The fellers measured and tallied the trees.

IV. Bucking.

It was found through experiment that one man understanding the work, and with a good saw, could buck as many Lodgepole pine logs as two men handling one saw could buck. The single man buckers preferred 5 or 5½ foot saws which were stiff. One man bucking timber into 10 and 14 foot length could keep up with the two fellers very readily.

V. Limbing.

A good axeman was chosen for the limber in each crew. The chief requirement in limbing was to chop limbs as close to the trunk as possible so that no snags would interfere with the logs when piled.

VI. Piling.

It was necessary to pile the green logs in the proper manner or they would not burn. First the bottom tier of logs had to be flat on the ground. If dead cross logs, rocks, etc., kept them from lying on the ground, a cross current of air was formed which caused the draught to run the wrong way and instead of the fire being sucked lengthwise through the pile of logs, thus consuming them, it would soon die out. The logs also had to be piled parallel in the pile and as close together as possible in order to get a clean burn. The number of logs to the pile depended upon the density of the trees treated. The piles were made as large as was possible, without increasing the cost, as the large piles burned the best.

PLATE II.

Infested Lodgepole Log Piles before Slashings are Thrown on.
This picture shows how logs should be piled in order to be
burned successfully.

PLATE III.

Infested Trees Converted into Logs and Piled with Slashings placed on Top, ready for Burning. The Standing Timber in Background is not Infested.

Treating Crew to Right of Picture.

(Taken from same position as Plates I and V).

After the logs were piled up, the slashings were thrown on top or piled to one side for burning. Experiments showed that the bare log piles burned almost, if not quite, as well as where the brush was piled on top.

VII. Barking Yellow Pine.

The infested Lodgepole and small Yellow Pines were peeled and burned, but the large Yellow Pines, because of their size and the value of the timber contained in them, were peeled of their bark and the bare trunks left on the ground. The slashings and the bark of trees infested with *D. brevicornis* were piled to one side for burning. Where the trees were infested with *D. monticola*, the bark was simply removed from the trunk and exposed.

The limber, buckler and pilers worked together when treating large Yellow Pines. The trees were usually dropped across a log or some object which would hold the tree up from the ground, so that the under side of the trunk could be peeled with ease. The tree was first limbed and the bark was then removed. Axes were used in removing the bark, which usually came off in big slabs without much difficulty. Wherever sections of the trunk contained no insects, the bark was left on to act as a trap tree for *D. brevicornis*. The bark on these trees will be removed and burned early next spring.

VIII. Burning.

Usually the burning of the log and brush piles was carried on immediately after the piling, by the respective crews doing

PLATE IV.

Burning Piles of Infested Logs and Slashings.

PLATE V.

Treated Area after Infested Timber has been Burned.

(Taken from same position as Plates I and III).

the work, but where weather conditions prevented burning until the crews were far ahead, a regular burning crew was put to work. Where conditions will permit, it is much cheaper and more satisfactory to have each crew burn its own piles. These should be fired in the morning or at noon as the men go to work and chunked up in the evening as they come in.

IX. Windrowing.

If care is taken in forming the windrows, the limbs and bark of the logs will burn and char the logs sufficiently to kill the insects. The logs usually remain on the ground, but by this method, the cost of the operation is reduced.

In some of the work on Happy Camp and Jackson Creek, this method was resorted to because the fire risk was very slight.

There is a difference between "windrowing" and "jackstrawing" the trees into large piles. The latter should never be used as a tangled mass of unsightly logs remains after the burning which interferes with the handling of stock on the range.

X. Logging with horses.

As an experiment, horses were occasionally used on this project for the purpose of skidding logs together for piling. The logs were bucked into 25 foot lengths and skidded to the log pile, where two men rolled them into the piles. Tongs were used in handling the logs. These were made of 7/8 inch octagonal steel with a swivel and a ring to attach the single tree or double tree into. 5/8 inch steel was used for one pair of tongs, but was found too light. In open country,

the team logging was found to be very satisfactory, but when there was much brush, or the slope was too steep, the results obtained were not so good. As the horses used were taken from the freight team, it was possible to use them only a day or two at a time, thus interfering with the experiment. It was found, however, that team logging can be used to advantage, and where conditions are favorable, horses should be used on future operations. Unfortunately it was not possible to gather accurate cost data for team logging.

The advantages are:-

1. Material decrease in cost of bucking logs.
2. Slight decrease in cost of piling logs.
3. Material decrease in cost of skidding logs together.
4. A saving of man power in handling the logs.
5. A material decrease in cost of burning, since the log piles are larger and there are fewer to be ignited.

When team logging is used, the crew should be divided as follows:

Crew for Team Logging.

- 1 span good steady horses or mules.
- 1 driver.
- 2 log pilers.
- 1 swamper - (where there is considerable brush).

To keep ahead of the logging crew the following men should be used:-

- 4 fallers (2 crews)
- 4 limbers
- 2 single man buckers

The limbers and swamper should endeavor to pile the brush out of the way so that the team can get round to advantage. There is no need of repiling the brush onto the piles of logs since it was found that the bare log piles burn as well without

the brush piled on them.

The falling crews should endeavor to drop all the trees in the same direction. They should not be thrown across each other, but should be felled parallel with each other.

XI. Saw Filing and Sharpening Axes.

A regular saw filer was employed to keep all the saws in shape. The filer was given charge of the saws, and he issued them to the various crews as needed. A saw rack with numbered grooves was made to hold the crosscut saws, and each saw was kept in its respective groove.

By working overtime, for which he was compensated, the filer was able to spend a part of the time in the woods doing regular work with a treating crew.

The men sharpened and kept in shape their own axes, which were charged directly to them.

XII. Freighting.

During the winter, three tons of equipment and supplies were freighted into Big Summit Prairie, which is near Badger Creek, and there stored. Bob sleds were used for getting the material in over the snow. The crusted snow was much easier to haul over than the bad roads of a month or two later.

During the operation, a six animal freight team was kept on the road most of the time hauling in provisions and men from Prineville, a distance of 60 miles over very bad roads.

XIII. Moving and Establishing Camp.

On April 10, a preliminary examination of the Badger Creek watershed was made to ascertain the condition of the insects.

the depth of snow and to choose a suitable camping place to work from. The snow was found to be from eight inches to four feet in depth, but owing to the advanced development of the insect larva, it was decided to begin the operation immediately.

On April 17, a six horse team with supplies and equipment and enough men to break the road and establish the camp, left Prineville for the lower end of Badger Creek. Five days later, a crew of seventeen men were sent in to begin actual work. As soon as these men were organized into crews and the camp was well established, which took about a week, the crew was gradually enlarged until sixty men were being employed.

It was found that $1\frac{1}{2}$ or 2 miles was the maximum distance crews should travel to work. For this reason, the camp was moved once in the Badger Creek watershed. This required the time of the freight team and 4 men for one day.

At the time the operation was transferred to Happy Camp Creek and Jackson Creek, moves of ten and seventeen miles were necessary. This move was made in sections.

As soon as the road was worked over a crew of ten men was moved to Happy Camp Creek, a distance of ten miles. When this camp was well established, it was enlarged by six more men. The remaining portion of the camp was then moved to Jackson Creek, a distance of seventeen miles. A half day's time for the entire crew was lost in this move as the men from the main camp stopped on their way to Jackson Creek and worked four hours on the Happy Camp Creek area.

XIV. Rules and Regulations.

During the season of 1912, it was found that some regulations and an understanding with the men regarding certain points was necessary. At the beginning of the work of 1913, the following regulations were issued and posted where all the men could read them and proved to be of great value in the administration of the work:

RULES AND REGULATIONS
Governing Employees
in
INSECT CONTROL WORK
Ochooco National Forest

- I. Wages. \$2.00 per day with board (8 hours' actual work per day) A charge of 25¢ per meal will be made when employees are in camp performing no duties, except Sundays, on which day no charge for board will be made. Men will travel to and from place of employment on their own time.
- II. Pay Rolls will be made up and sent into the office at the end of each month. Meals will be served at regular hours. No meals will be served to employees arriving late, unless special arrangements have been made with the officer in charge of the camp.
- III. Employees will not be permitted to loiter in the cook tents.
- IV. Transportation to camp will be provided by the Government. Transportation from camp to Prineville will be provided by the Government at close of season. Employees leaving camp for any reason before the close of the working season must provide their own transportation out, or take advantage of freight teams leaving the camp. No special trips will be made.
- V. Baggage and Personal Equipment to be hauled into camps by Government teams is limited to 100 pounds per man.
- VI. Employees are expected to furnish their own beds and personal equipment such as towels, laundry soap, etc.
- VII. The Government furnishes shelter in the form of tents and all equipment such as axes, saws, etc.
- VIII. No dogs, firearms or liquor will be permitted in camp.
- IX. Employees will not be permitted to turn horses into Ranger Station pastures.
- X. No bankings of earth or moisture holding material which will tend to rot canvas, will be permitted around the base of Government tents.
- XI. Government Camps must be kept in a clean and sanitary condition.

FOREST SUPERVISOR.

XV. Personnel.

Undesirable laborers were discharged as soon as their traits were learned, and only men who could and would put in eight good hours of labor were retained.

In order to more clearly watch the work of each crew, and to arouse a keener interest in the work among the men, the results of each day's work were figured up at night and tabulated as follows:

Name of Crew												Extended		
Date:	Cayton	Raudenbush	Warren	Merritt	Cook							Totals :		
June:	L.P.:	Y.P.:	L.P.:	Y.P.:	L.P.:	Y.P.:	L.P.:	Y.P.:	L.P.:	Y.P.:	L.P.:	Y.P.:		
4	44	2	71	8	35	21	60	3	31	7	241	41		
5	22	8	121	--	78	9	99	34	28	3	348	54		
6	28	42	41	23	52	11	9	61	13	18	143	155		

The totals were then posted on a bulletin board where the men could see them, thus:

Number of Trees Treated June 5.

Lodgepole Pine--348 (Record out for Lodgepole to date)
Yellow Pine-----54
Total-----402

Number of Trees Treated to Date.

Lodgepole Pine 6,320
Yellow Pine---1,135
Total-----7,455

The bulletin board was also used to show any changes in the personnel of crews or location of work, and general announcements.

This system proved of great advantage by creating interest and by eliminating confusion.

PLATE VI.

Insect Control Crew of 1913.

C. COST DATA.

I. Segregated Cost of Operation per M.B.F. and per Tree.

Segregation	Total	Cost	Cost
	Cost	per MBF	Per Tree
1. Marking, etc.----- (Wages only)	\$300.00	0.162	0.025
2. Felling----- " "	676.08	.365	.052
3. Bucking----- " "	341.61	.184	.026
4. Limbing----- " "	677.27	.366	.053
5. Piling logs and brush-- " "	1355.65	.732	.106
6. Burning----- " "	238.64	.183	.026
7. Supervision and Travel- " "	438.06	.237	.035
8. 2/3 Freightng (Wages and all expenses)-----	541.84	.185	.026
9. Moving Camp & Road Repairing, (Wages only)-----	78.75	.042	.006
10. Field Equipment (33-1/3% depreciation)-----	137.52	.074	.010
11. Meals (Including cook's wages, 1/3 of freightng, etc.)-----	2098.69	1.133	.163
Total Field-----	6,784.11	3.663	.527
12. Office work-----	38.90	.021	.003
GRAND TOTAL-----	6,823.01	3.684	.530
Value of Equipment on Hand-----	315.05	---	---
TOTAL EXPENDITURES-----	7,138.06	---	---

II. Total Segregated Cost of Operation.

<u>Segregation</u>	<u>Total</u>
1. Cost of Labor-----	\$2,903.51
2. Cost of Provisions-----	1,559.41
3. Total Cost of Equipment (Field & Cooking)----	472.57
4. Total Cost of Freightings-----	512.75
5. Travel Expense for Forest Officer-----	41.76
Total-----	\$5,500.00
6. Cost of Forest Officer's Time in Field, (Pernot, Fuller and Hodgson)-----	599.16
7. Cost of Forest Officer's Time in Office-----	38.90
Grand Total-----	\$7,138.06

III. Segregated Cost of Board.

<u>Segregation</u>	<u>Total</u>
1. Wages for Cooks-----	538.37
2. Cost of Provisions-----	1,569.41
3. Cost of Cooking Equipment (33-1/3% depreci- ation)--	20.00
4. Cost of 1/3 of the Freightings-----	170.91
Total-----	\$2,098.69
Total number of meals served-----	6,883.
Average cost per meal-----	.305
Cost of food per man per day-----	.684
Total Cost of board per man per day-----	.915

IV. Cost based on \$6,500. Allotment.

Timber Treated with \$6,500. Allotment	Cost	
	Per Tree	Per MBF
Total number trees treated (12,873)	.505	6,500.00
Total volume treated (1,852 MBF)	3.51	6,500.00

D. STATISTICS ON LABOR.

1. Number of Men Employed During Run of 64 Days by Classes*

Total Number	Average Number Per Day	Class	Rate of Pay**
1	1	Deputy Forest Supervisor	\$1,400 per year
1	1	Forest Assistant	1,200 " "
1	3/8	Forest Assistant	1,100 " "
1	1/2	Asst. Forest Ranger	1,100 " "
1	1	Forest Guard	1,100 " "
1	5/8	Cook	\$2.50 " day
2	5/8	"	2.25 " "
4	1	"	2.00 " "
1	1	Saw Filer	.25 " hour
1	1	Teamster	\$75.00 " month
8	1-2/3	Laborers	2.25 " day
75	21-2/10	Laborers	2.00 " "
97	31-1/9	Average Rate per Day-----	2.33 " "

*Sundays and days on which no work was performed are included in this 64 days.

**Board provided in addition in all cases.

E. STATISTICS ON TIMBER TREATED.

I. Number of Trees Treated by Sections, and Ownership.

Township	Range	Section	Yellow Pine	Lodgepole Pine	Total
138	22E	5(USFS)	68	1,039	1,107
		5(Key's claim)		298	298
		7(USFS)	47	194	241
		8(USFS)	916	3,066	3,982
		16(School)	686	454	742
		17(USFS)	359	818	1,178
		17(Jones claim)		46	46
		18(USFS)	80	273	293
138	22E	31(Outside boundary)	24	113	137
		32(USFS)	7	515	520
		32(Key's claim)	56	451	457
		32(Fulston claim)	60	569	429
		33(USFS)	44	17	65
138	23E	18 "		1,874	1,874
		34 "	12	872	884
		35 "		328	328
142	23E	2 "		10	10
		3 "		464	464
Total			1,981	10,992	12,973

II. Number of Trees Treated by Watersheds.

<u>Watershed</u>	<u>Yellow Pine</u>	<u>Lodgepole Pine</u>	<u>Total</u>
Badger Creek	1,869	7,434	9,303
Jackson Creek	12	1,684	1,696
Happy Camp Creek	---	1,874	1,874
<u>Total -</u>	<u>1,881</u>	<u>10,992</u>	<u>12,873</u>

III. Area Treated.

Approximate Area Actually Treated - - - - 3,600 acres.

Approximate Area Benefitted by Work - - -12,000 "

IV. Total Number Yellow Pine Trees Treated by Diameter and Height Classes, showing Volume in Board Feet.

Total Height in Feet.																	Total	Board
DBH	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	Trces	Feet	
4	20	16	5													41	145	
6	16	62	74	3												175	1,516	
8		14	101	82	16	3										216	6,550	
10		6	59	98	68	25	2									253	13,920	
12			9	43	61	65	33									211	22,240	
14			1	14	50	41	34	10	1							151	27,100	
16			2	6	15	26	35	12	3	1						100	26,000	
18			1	3	13	40	34	24	16	2						133	45,945	
20					4	37	41	35	19	4	1					141	60,385	
22					2	14	27	24	18	3						88	52,085	
24						8	28	37	19	14	5	1		1		113	82,105	
26							22	18	25	5	2	1				73	63,390	
28							5	8	19	3	1			1		37	42,500	
30							2	6	14	5	6	2	1			35	52,170	
32							1	3	10	7	1	1				23	40,370	
34								1	5	4	4	1				15	30,610	
36								1	5	6	6	6	3	2	1	30	78,400	
38										4	1	5	1	1		12	36,670	
40									2	1	1	1			1	6	19,630	
42									1	1	3	1				6	13,880	
44								1			1		1	1		4	18,400	
46								1			1		1			3	16,890	
48										2		1		1		4	24,800	
50														2		2	13,680	
52												1				1	7,500	
54																		
56											1					1	9,630	
58																		
60												1				1	10,400	
62																		
64														1		1	11,960	
To-																		
tal	36	118	252	249	229	259	254	181	157	62	33	22	8	9	2	1,861	829,051	

V. Total Number Lodgepole Pine Treated by Diameter and Height Classes, Showing Volume in Board Feet.

Total Height in Feet

DBH	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	Total Trees	Board Feet
4	18	15	13	4																			50	203
5	16	43	31	26	5	3																	124	1,265
6	24	114	166	111	50	38	17	9	4	2													535	5,500
7	12	35	112	177	155	93	46	24	13	4	2												675	11,942
8	12	34	85	200	264	228	113	97	45	5	7	1		1									1,092	27,140
9	2	12	52	168	277	294	196	194	78	24	14	3	1	1									1,316	43,696
10	2	10	19	86	180	249	225	309	246	242	87	22	6	1									1,684	87,770
11	1	4	7	21	68	118	164	219	196	157	188	32	18	4									1,197	89,775
12	1		10	25	63	122	122	242	262	214	247	190	42	12	3								1,555	155,500
13			1	3	20	56	47	127	116	139	99	112	103	18	4	1							845	105,625
14				2	10	21	46	66	73	107	101	64	71	62	12	3							638	102,080
15				1	4	8	16	26	37	49	63	47	34	25	13	7		1					331	66,200
16					6	4	8	26	31	46	46	36	32	26	13	9	1	1			1	1	287	68,880
17						2	1	11	14	20	21	34	28	21	12	5	1	2	2		1	1	176	52,800
18				1	1	1	2	7	20	26	24	36	21	25	18	15	3			1	2	1	203	71,050
19			1			2	1	4	6	6	6	10	20	9	7	4		1		1	2	1	81	30,780
20						1	1	2	3	10	11	11	10	11	6	7	3	3					78	32,760
21							1	5	1	1	6	6	2	4				1		1	1		29	13,630
22								1	1	4	6	4	2	5	2	1	3	1					29	14,790
23									1	1	2	2	2		4	3	1	1	1				18	10,170
24								1			3	7	5	5		1	2	1		2	1		26	15,860
25										2		2	1			1	2	2					10	6,300
26										1		1	1										3	1,950
27											1				2	1							4	2,680
28											1			2				1					4	2,760
29														1									1	730
30														1									1	760
Total	88	267	497	825	1103	1240	1008	1370	1147	1051	935	620	399	234	94	57	16	14	3	5	8	3	10,992	1,022,596

F. EQUIPMENT USED.

Number

Axes - Double Bitted-----	65
Axes - Pole-----	4
Axes - U. S. Marking-----	5
Bags - Water-----	8
Binoculars-----	1
Brace and Bits - Carpenter-----	1
Chain - Surveyor's (66 ft)-----	1
Compasses - Box Pocket-----	2
Compasses - Forest Service Standard-----	2
Cooking Outfit for 60 Men-----	1
Drill - for Use in Blasting-----	1
Files, 7 and 8 inch-----	48
Flag - U. S.-----	1
Forks - 4-tine pitch-----	8
Grindstones-----	2
Hammers - Carpenter-----	2
Hammers - Sledge-----	10
Handles - (extra) for sledges and axes-----	
Hatchets-----	2
Horse Shoeing Outfit-----	1
Lanterns-----	4
Medicine Kit-----	1
Nails-----	
Peavies-----	5
Picks-----	3
Pins - Surveyor's-----	11
Plow - side Hill-----	1
Powder, fuse, caps (for blasting)-----	
Pulley - small (for meat and flag)-----	4
Punch - Flat iron for extracting handles-----	1
Registers - Tally-----	4
Rope-----	
Saw Filing and Setting Outfit-----	2
Saws - Crosscut-----	16
Saws- Hand-----	2
Scribe-----	1
Shovels-----	12
Shoe Repairing Outfit-----	1
Stones - Pocket whet-----	16
Spikes-----	

Tonge (for skidding logs)----- 2
 Tents - enough to shelter 60 men-----
 Wedges-----12
 Wheel - Emery----- 1
 Wire - Baling-----

G. WORKING PLAN.

I. Present status of Infestation.

The Insect Control work on this Forest has retarded the action of the bark-beetles to a marked degree, but it has not by any means controlled them. Very few active bark-beetles were left in Badger Creek, but over the entire Forest are small groups of infested trees, and in the Deep Creek watershed, which lies near the center of the Forest, is a very heavy infestation. This outbreak of beetles was probably checked somewhat by the work done this year on Happy Camp and Jackson Creek, but it was not put under control, and many active insects were left.

II. Map and Report of Infestations Being Made.

The data for a report and map showing the extent and location of all active infestations on the Forest is now being collected by Forest Assistant Fuller. This report and map will constitute a basis for the 1914 operation.

III. Three Steps in the Working Plan.

In order to successfully control the bark beetles, it will be necessary to work in accordance with a plan, extending over a period of several years. For this reason, one has been outlined that is made up of three distinct steps, which are:

1. Control of heavy infestations by large crews.
2. Control of small and scattered infestations by small crews.
3. Control of individual infested trees by patrol guards.

1. Control of Heavy Infestations by Large Crews.

Owing to the great expense of maintaining and moving large crews of 15 to 60 men, they should be used only where the insect infestation is very heavy and there are a great many trees to treat in a compact body, such as was found in the Badger Creek watershed. For obvious reasons, it is essential to get such outbreaks under control first, by means of large crews.

This step in the plan has now been completed on Badger Creek and was begun on the Deep Creek watershed, which is made up of Little Summit, Jackson, Derr, Corral Springs, Happy Camp and Crazy Creeks, where the operation should be continued in 1914.

2. Control of Small Infestations by Small Crews.

Scattered over the Forest, outside the range of the main infestations, are small outbreaks of bark beetles where from 20 to 200 trees are infested. Because of the small size and scattered condition of these areas, it will be necessary for a treating crew to move frequently. Therefore, the crews should contain from 4 to 8 men who are reliable, and should be in charge of one man who has had previous experience in insect control work. Each small crew should be assigned to a certain watershed or district to work in. There should be with each crew a marker who will mark the infested timber, scout ahead for new areas to work on, and make a map showing the location and extent of treated areas. For two or three such crews, a packer with pack animals must be had who will move camps whenever necessary and pack in provisions.

Areas such as the ones on Marks, Gray's, Howard, Black Canyon and Emigrant Creeks should be treated in this way, and during 1914, the work on Badger Creek should be gone over by a small crew.

3. Control of Isolated Infested Trees by Patrol Guards.

As the Forest is worked over by steps 1 and 2, the work should be followed up by "Insect Patrol Guards" who should travel in pairs and be fully equipped with saddle and pack horses, camp equipment and treating implements. The Forest should be divided into Insect Patrol Districts and two such guards assigned to each.

The Insect Patrol Guards will then ride their districts for the purpose of finding and treating all infested timber within its boundary. Whenever infested trees are found, the guards will make camp and proceed to treat them.

The same men who are used as fire guards later in the season could be employed on this work.

By adhering to the three steps in the plan, it will not take long to control the bark beetles on this Forest.

IV. Summary of Past Results Accomplished by Years.

(a) 1910.

(1) Crew of 4 rangers worked in upper portion of Badger Creek during winter months. No perceptible results.

(b) 1912.

(1) Crew of 15 men located in Upper Badger Creek May 5 to June 26. Heavy infestation of insects in Upper Badger Creek put under control by treating 3400 trees.

(c) 1913.

(1) Crew of 28 men worked from April 17 to June 10 in Lower Badger Creek and on Mill Creek. Heavy infestation put under control by treating 9,303 trees.

(2) Upper Badger Creek cruised out by small crew and scattered infestations treated.

(3) Crew of 16 men worked from June 11 to June 19 in upper portion of Happy Camp Creek (Deep Creek watershed). Heavy infestation checked but not entirely controlled.

(4) Crew of 24 men worked on Jackson Creek (Deep Creek watershed) from June 14 to June 19. Heavy infestation checked but not entirely controlled.

V. General Plan for Future.

(a) 1914.

(1) Small crew of 4 men assigned to Badger Creek watershed April 25 to June 10. These men should carefully go over every section in the basin as well as the rim of the summit and treat all infested timber.

(2) Two small crews of 6 men each should treat the following areas April 18 to June 10; Marks Creek, Rush Creek, Howard Creek, Gray's Creek, areas north of Pisgah Mountain, and other small areas which are later discovered.

(3) Small crew of 8 men assigned to Deep Creek Basin June 1. This crew should work over the areas on Jackson and Happy Camp which were treated in 1913.

On June 12, this crew should be strengthened by the three crews mentioned above, making a large crew of 32 men. They should work until July 20, and should cover all the stream basins tributary to Deep Creek.

Estimated Cost:

Labor-----	\$3,720.00
Board-----	1,900.00
Freighting and Packing-----	700.00
Incidentals-----	30.00
	<u>\$6,400.00</u>

(b) 1915.

(1) Patrol Insect Guards (the number to be determined at a later date) should be employed April 15 to June 10 and should cover all territory from Badger Creek and Big Summit Prairie West. They should treat all infested trees that are found.

(2) On June 10, two small crews of 5 men each should be sent to Deep Creek. The Deep Creek Basin should be thoroughly gone over by these crews between June 10 and July 20.

(3) Operations should be carried on in the northeast portion of the Forest, but a plan for this work should be made after a more intensive study of conditions.

(c) 1916.

(1) Forest should be patrolled for infestation of bark beetles by guards during the proper months.

Note: The above working plan should be worked over every year and changed or modified as conditions demand.

H. CONCLUSION.

1. It is recommended:

a. That the work of insect control be continued on this Forest with the aim of determining whether or not bark beetles can be artificially controlled.

b. That the work of 1914 be governed by the above plan.

c. That \$6,400 be allotted to this Forest to carry on the control work of 1914.

d. That the allotment be made so that \$4,800 will be available in the Fiscal Year 1914 and \$1,600 will be available in the Fiscal Year 1915.

Approved, August 26, 1913.

HOMER ROSS,

Forest Supervisor.

Respectfully submitted,

ALLEN H. HODGSON,

Deputy Forest Supervisor.